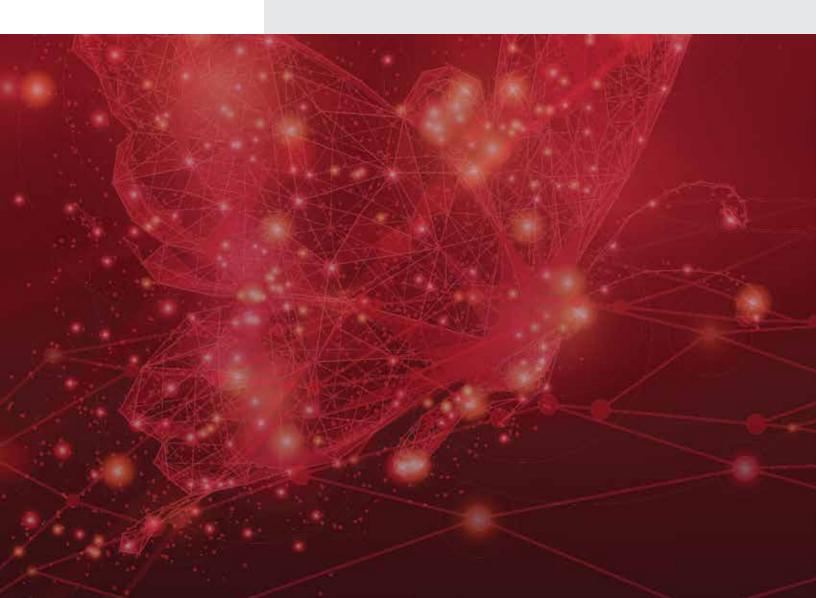# Achieving Real-Time Financial Regulatory Compliance with In-Memory Computing

A GridGain Systems In-Memory Computing White Paper

REAL-TIME FINANCIAL REGULATORY COMPLIANCE

Unprecedented and growing technical challenges face today's financial services organizations. Stringent regulations and client protection initiatives enacted in the wake of the 2008 financial meltdown pose tough requirements for validation of financial transactions. Banks and other financial institutions must monitor, collect, and analyze vast amounts of data from multiple, disparate sources in real-time. Coping with these challenges in an efficient way will require an extremely fast, scalable, and cost-effective data technology.

This paper provides an overview of the current economic and regulatory environment, focusing particularly on new and recent regulatory initiatives. It then discusses how the banking industry is addressing today's daunting challenges with new business strategies and innovative technologies.

ECONOMIC OUTLOOK UNCERTAINTY

The current economic outlook is full of uncertainty. There has been a modest amount of economic growth following the 2008 financial crisis, with low inflation and low interest rates. However, there has also been one of the slowest economic recoveries in recorded history.

Both developed markets and emerging markets are demonstrating stagnation and the forecast is pessimistic. It's not clear where economic growth will come from. Worldwide, there are many troubling geopolitical issues—such as Brexit—with financial implications that have yet to be resolved.

In addition to the effects of a weak economy, financial institutions are dealing with significant fallout from the 2008 crisis in the form of regulatory tightening and reduced profits. The ROE (return on equity) profitability measure is now below the normal 10 percent for the top ten global banks. "Easy money" is no longer available as banks allocate reserves for new expenses and requirements.

POST-2008 BANKING: TIGHTER REGULATIONS, TIGHTER BELTS

In the post-2008 environment, the banking industry faces a host of new pressures, including:

• Regulatory tightening from governing bodies in the U.S., E.U., APAC and other regions to ensure that banks and overall economies are stable enough to prevent a repeat of the 2008 meltdown

• Low stock prices relative to historical values, pressing the banks to act more cautiously

• De-leveraging pressures pushing banks to reduce the debt and risky assets on their balance sheets, in order to demonstrate that they pose no risks to the economies in which they operate

• Penalties and compliance costs relating to issues going back to the 2009-to-2011 timeframe—and requiring banks to allocate funds for any additional such costs that may arise in the future

• Litigation costs for legal actions in the wake of the 2008 crisis, for which fines have exceeded $230 billion—more than the capitalization of some of the largest banks combined

Banks are responding to these pressures in multiple ways. They are cutting costs, restructuring, and optimizing certain business lines. They are selling non-core assets, exiting less profitable activities, and refocusing on more profitable ones. And, finally, they are embracing new technology that can help them operate efficiently in the new regulatory environment.

Before we look at the specifics of this new technology, let's look more closely at the regulatory situation that banks are dealing with today.

MAJOR NEW REGULATIONS AFFECTING BANKS

Banks today must comply with significant new regulations. In the E.U., these regulations include Basel III and IV, MiFID II, the Net Stable Funding Ratio, and the Culture and Ethics Standard in Banking. In the U.S., they include CCAR, IHC, Enhanced Prudential Standards, Dodd-Frank Living Wills, Basel III, and Enhanced Consumer Protection.

Many of these regulations center around the riskiness of assets that the banks hold in their portfolios. They involve tracking a bank's constantly changing assets, weighting them by risk level, and evaluating them against acceptable levels of exposure. Other regulations, such as the Culture and Ethics Standard in Banking in the

E.U. and the Enhanced Consumer Protection regulations in the U.S., involve monitoring transactions and applying analytics to look for ethical violations.

Let's look at these regulations in more detail.

Basel III and IV. Under the capital requirements directive in Basel III, E.U. banks must hold reserved capital greater than 8 percent of their risk-weighted assets (RWA). This requirement will be even higher in Basel IV.

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Banks must track the values of their assets essentially in real-time to make sure they are meeting these requirements. While reports go to the regulators on a quarterly basis, monitoring must happen on a daily basis, so that banks can respond to changes in the market, changes in the profit and loss statement (P&L), changing prices of various assets within the portfolio, and changing conditions in various geographical regions.

Tracking and analyzing the assets of a large financial institution in real time involves a lot of data—and significant system expense in getting a system like this ready for compliance purposes.

CCAR (Comprehensive Capital Analysis and Review). CCAR is a regulatory framework introduced by the Federal Reserve in order to assess, regulate, and supervise large U.S. banks. As with Basel, it involves looking at all of a bank's assets and how thy are graded in terms of risk. Banks must run special stress tests based on various scenarios— for example, the interest rate growing 10 percent, or the currency rate changing significantly. Banks must analyze how their portfolios are affected by those changes.

The bottom line with CCAR is that the system must be agile enough and scalable enough to perform all of these stress testing scenarios in more or less real time, so that banks can submit their reports to the Federal Reserve Bank in a timely manner.

IHC (Intermediate Holding Company). An important new requirement in 2016 is that every non-U.S. financial organization having U.S. legal entities with more than $50 billion of assets must have an operating IHC. Such organizations (which include the Deutsche banks, Credit Suisse, UBS and others) must create separate entities that are capitalized and operational and that participate in all of the capital analysis tests that the Federal Reserve Bank runs.

So, even though these are non-U.S. headquartered institutions, they must still participate in tests similar to those that larger U.S. institutions participate in. Many of these banks have been working hard and spending a lot of money to be in compliance with IHC.

MiFID II (Markets in Financial Instruments Directive). This huge E.U. initiative is a second version of standard MiFID, which covers execution requirements for customer orders. MiFID II extends the requirements to cover all instruments traded in Europe today, requiring banks to price markets and perform compliance checks both before and after executing orders. They must look at trends and prices, making sure that the price offered or bid is within a certain threshold of where that security is trading in the market.

In regulating previously unregulated trading facilities—all those alternative marketplaces where OTC securities are traded—MiFID II includes requirements for safety of algorithms and high- frequency trading activities. Orders in these markets will need to satisfy risk controls and compliance checks similar to those for traditional market orders. MiFID II also requires a similar type of governance and coverage of derivatives transactions, under supervision by ESMA, the European Security Market Association.

In addition, MiFID II includes stricter requirements for portfolio management and investment advice. There are new time-stamping requirements for all orders executed by portfolio managers. The goal of the requirements is to capture the following information for use in potential audits: when the intention to buy or sell securities was first demonstrated, when the first contact with the broker was established, when the order was placed, when the order was executed, and when the order was reported.

This data capture takes place in a more rigorous "rest execution" scenario than before. Previously, with MiFID, a broker had to evaluate where the best price was and send the order to be executed on that exchange or in that marketplace. With MiFID II, brokers must not only look for the best prices but also capture the environment, as proof that orders are executed on the platform with best price.

The result is that much more data has to be captured and stored someplace—not just the order data, but also all of the information in the market at that particular time of execution. And banks need to be able to retrieve this data quickly. To meet all of MiFID II's new investor protection and risk-control requirements and still maintain low- latency, microsecond-level results, banks need to invest in systems that can provide the fastest performance possible.

Net Stable Funding Ratio. This regulation, which comes from Basel committee and is obligatory in the USA, requires financial institutions to hold cash someplace to cover potential losses during the year. There is usually an audit by the regulators to determine the quota of cash that must be held, and banks must monitor their risk profiles to see whether the amount they need to hold is over or under that minimum.

Enhanced Prudential Standards. This initiative from the U.S. Federal Reserve requires large financial institutions to monitor risk management across the entire enterprise, not just within individual business units such as wealth management, brokerage, and retail. To meet this mandate, large amounts of data must flow from those individual units to a centralized unit, which will then use its own risk- management analytics to understand the risk management situation

for the enterprise as a whole.

Culture and Ethics Standard in Banking. This initiative from the Financial Stability Board in Basel requires banking institutions to implement analytics to look for unethical transactions such as bribery, money laundering, or conflicts of interest. Banks need a mechanism of capturing such transactions, monitoring them, reporting on them, acting on them, and creating a case around them if necessary. This is yet another situation requiring large amounts of data and real-time analytics.

Dodd-Frank Living Wills. Under the Dodd-Frank Act in the U.S., living wills are mandatory for banks with over $50 billion in assets. Each of these banks must create a trouble-resolution financial plan and file it with the government. If anything changes with respect to its financial situation or financial holdings, the bank must redefine the plan and notify the regulators. Banks are expected to monitor their situations actively and respond promptly to changes over a certain threshold.

Enhanced Consumer Protection Through Dodd-Frank and the Services Directive. Dodd-Frank in the U.S. and the Services Directive in the E.U. protects consumers by requiring banks to do more to validate suspicious transactions. Such validation procedures also protect banks from liability for customer wrongdoing — the fines can be very high in such situations.

PROACTIVE BANK CONTROLS TO AVOID LITIGATION

To respond proactively to the new regulatory environment and avoid further litigation burdens, banks are implementing or strengthening the following types of measures:

- **Anti-money-laundering (AML) controls**. Banks are trying to monitor where money is going — tracking source and destination of transactions, whether amounts are in line with the previous transactions — and do so in real time, prior to approving the transaction. Successful monitoring requires real-time analytics so that the monitoring is not noticeable to consumers yet is still comprehensive enough to protect the bank from any potential suits from the government.

- **Know your customer (KYC) controls**. Banks are now monitoring a large data environment (reporting bureaus, social media, and so on) for the types of information about their customers that they must report and update. They record the information where it will be accessible by various units and systems if the customers perform certain banking activities.

- **Sanctions and cybercrime controls**. Many countries and companies around the world are under sanctions, and financial institutions face serious fines when they don't implement sanctions and cybercrime controls such as creating cross-reference tables that are constantly updated or purchasing specialized software.

- **Anti-fraud, anti-corruption, and anti-bribery controls**. Banks are evaluating every transaction against the customer's historical patterns, and they are making sure that any entities that are potentially on the bribery lists are flagged if there is a transaction going through them. This process involves maintaining the relevant information within their systems and implementing appropriate checks and validations before transactions can be completed.

- **Real-time trade compliance monitoring**. As noted earlier with respect to investment banking and wealth management, trades now require both pre-trade and post-trade compliance checks to be done in real time, rather than allowing post-trade checks to be done later. If certain actions occur—for example, if someone trades a lot of stock right before certain news comes out about that stock — this information must immediately be reported to compliance groups within the banks. At least one bank is also now monitoring voice communications among brokers and clients, checking for words that might indicate issues for concern. The overall result: much data recording and analysis to support active monitoring and actions to stop unethical or problematic transactions.

- **Supervisor accountability controls**. For each trade or transaction process there is a supervisor who must sign off on the process. Supervisors are monitoring the activities of their traders, their tellers, and their portfolio managers—often in real time. If something is not right, the monitoring systems need to alert the supervisors either prior to the compliance officers or simultaneously with compliance officers so that action can be taken right away.

- **Proactive monitoring of high-risk countries**. Client relationships in risky countries and countries with sanctions against them require extra transaction scrutiny. In today's banks, most of this scrutiny is happening electronically, from the capture and analysis of data to the issuing of alerts.

- **Internal ethics controls**. Ethics codes within financial institutions require accountability for conduct issues such as people accessing data they are not supposed to access. Here again, monitoring systems are important for quickly detecting and reporting problems.

Naturally, the need to implement all of these new and increased controls in an efficient and responsive manner is having technology implications.

PROACTIVE BANK CONTROLS TO AVOID LITIGATION

With today's environment, banks need to move away from their traditional modes of operation and make better use of technology. The technical needs of today's banking industry have sparked a number of trends, including the following:

- **Disruption from fintech firms**. Realizing that banks lack experience at addressing electronic issues, new technology companies are moving in on some profitable aspects of the banking business. Areas in which fintech firms have taken some business away from banks include electronic payments, personal finance management, lending, investments, and even core banking.

- **Bank investments in innovation**. As banks try to navigate evolving technologies and retain customers, they are making strategic investments in open source technologies and other areas. They're trying to partner with technology firms and create innovation labs to test new technologies. They know they need to find the right technology to help them deal with big data and perform real-time monitoring, analytics, and transaction processing.

- **Digitalization**. With most of the processes that were historically done at the end of the day or manually now being moved into real time, banks are moving to electronic, automated strategies to replace these traditional processes.

- **Cloud services for core activities**. Banks are investing in cloud services for numerous reasons: scalability, cost savings, better access to data, ease of moving and reusing data, and the need to remove silos and have all of the data in one place. At first, the focus was on private clouds, but banks are now experimenting with hybrid and public clouds as well.

- **Architecture simplification**. Banks are trying to simplify architecture and get rid of legacy systems to move toward faster, more agile technologies that improve time- to-market for new channels and products.

- **Blockchains and distributed ledgers**. Distributed-ledger technologies, such as the blockchains pioneered by Bitcoin, allow a ledger of digital records to be securely distributed across a network and quickly accessed by all computers running a specific protocol. Banks are using these technologies — in conjunction with faster, higher-performance systems for data exchange — to reduce the time needed to execute trades, clear trades, and change the registry on trades.

- **Big data and advanced analytics**. As data input has increased, along with the storage of extremely large datasets, banks have devoted an ever-higher proportion of their data initiatives (now about 72%) to advanced analytics: predictive analysis, data mining, big data/ fast data, simulation, optimization, and location-based intelligence. Performing these advanced analytics quickly, particularly with disc-based systems, has become a major challenge. Speed is a challenge at the transactional level as well, as performing big- data related controls can cause customers to notice significantly slower transactions.

- **In-memory computing**. In- memory computing, including in- memory data grids, can address many of the problems financial organizations face in using disc- based systems for big data: performance issues — such as discs being too slow to trade, process events, or perform risk and compliance functions — and the need for scalability. Because in-memory computing allows data to be stored in RAM across a cluster of computers and processed in parallel, it operates hundreds of times faster than traditional computing and allows easy addition of more and more nodes to the cluster.

BANKING ON IN-MEMORY COMPUTING

With the tight regulatory environment and cost pressures that banks are facing today, they need big-data technologies that make their risk-management, monitoring, and compliance processes much faster and more efficient. Large financial institutions accumulating massive amounts of data need to be able to perform analytics on that data in real time, so that transactions can proceed with minimal impact on customers. And they need to do so in a cost-conscious manner, given the current financial environment and low share prices.

Many banks are finding in-memory computing products such as GridGain to be a key strategy for meeting this challenge. Sberbank, for example, is moving most of their transactional processing and analytics onto GridGain, which showed the best performance and scalability results in an evaluation of more than ten competitors. With GridGain, they were able to generate about one billion transactions per second in a test environment — all on 10 Dell R610 blades, which cost them about $25,000.

High-performance, low-cost results like these show why in-memory computing will be a vital part of the strategy that banks use in achieving real-time financial regulatory compliance.

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Contact GridGain Systems

To learn more about how GridGain can help your business, please email our sales team at sales@gridgain.com, call us at +1 (650) 241-2281 (US) or +44 (0)208 610 0666 (Europe), or complete our contact form at www.gridgain.com/contact and we will contact you.

About GridGain Systems

GridGain Systems is revolutionizing real-time data access and processing with the GridGain in-memory computing platform built on Apache® Ignite™. GridGain and Apache Ignite are used by tens of thousands of global enterprises in financial services, fintech, software, e-commerce, retail, online business services, healthcare, telecom and other major sectors, with a client list that includes ING, Raymond James, American Express, Societe Generale, Finastra, IHS Markit, ServiceNow, Marketo, RingCentral, American Airlines, Agilent, and UnitedHealthcare. GridGain delivers unprecedented speed and massive scalability to both legacy and greenfield applications. Deployed on a distributed cluster of commodity servers, GridGain software can reside between the application and data layers (RDBMS, NoSQL and Apache® Hadoop®), requiring no rip-and-replace of the existing databases, or it can be deployed as an in-memory transactional SQL database. GridGain is the most comprehensive in-memory computing platform for high-volume ACID transactions, real-time analytics, web-scale applications, continuous learning and hybrid transactional/analytical processing (HTAP). For more information on GridGain products and services, visit www.gridgain.com.